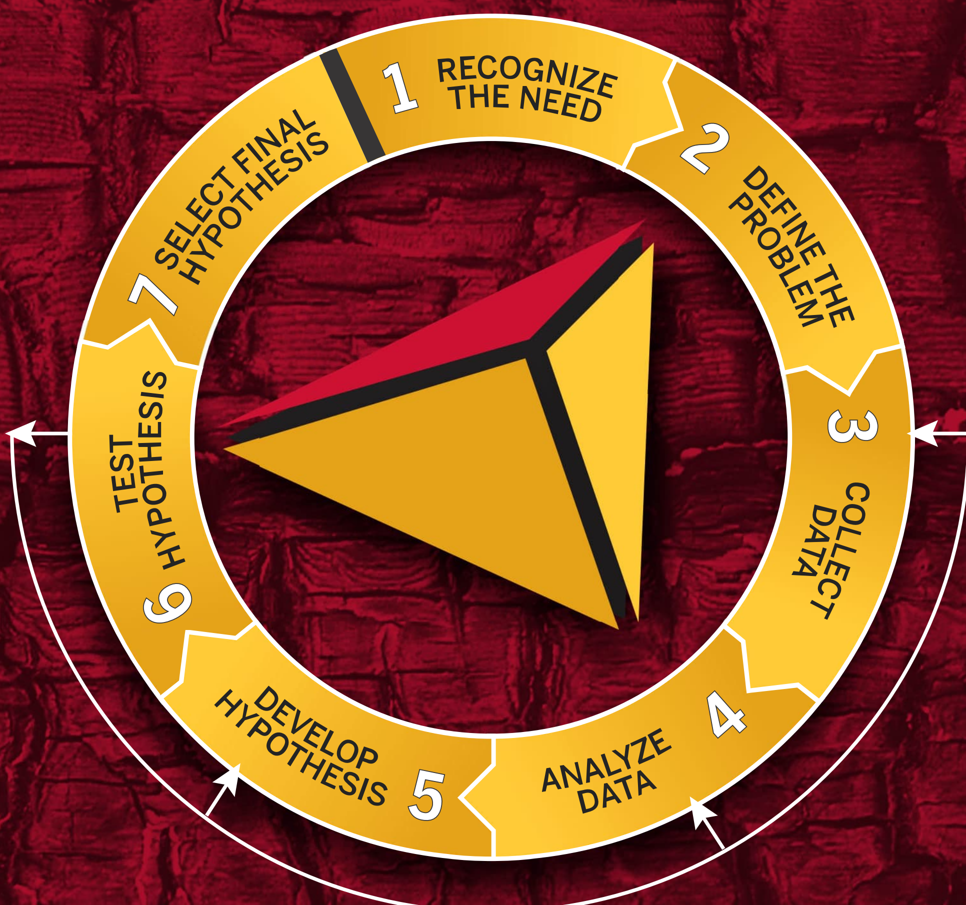
EXHIBIT 1

NFPA® 921

Guide for Fire and Explosion Investigations

2017



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17.10.2.24 Pressure and Rate of Pressure Rise for Combustible Dusts (ASTM E1226). This test method, from ASTM E1226, *Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*, can be used to measure composition limits of explosibility, ease of ignition, and explosion pressures of dusts and gases.

17.10.2.25 Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter. This test method, from ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, is a bench-scale laboratory instrument for measuring heat release rate, radiant ignitibility, smoke production, mass loss rate, and combustion products (including such gases as carbon monoxide and carbon dioxide), from burning materials.

17.10.2.26 Ignition Properties of Plastics (ASTM D1929). This test method, from ASTM D1929, *Standard Test Method for Determining Ignition Temperature of Plastics*, covers a laboratory determination of the self-ignition and flash-ignition temperatures of plastics using a hot-air ignition furnace.

17.10.2.27 Dielectric Withstand Voltage (Mil-Std–202F Method 301). This test method, from Mil-Std–202F, *Test Method for Electronic and Electrical Components*, also called high-potential, overpotential, voltage-breakdown, or dielectric-strength test, consists of the application of a voltage higher than rated voltage for a specific time between mutually insulated portions of a component part or between insulated portions and ground.

17.10.2.28 Insulation Resistance (Mil-Std–202F Method 302). This test, from Mil-Std–202F, *Test Method for Electronic and Electrical Components*, measures the resistance offered by the insulating members of a component part to an impressed direct voltage tending to produce a leakage current through or on the surface of these members.

17.10.3 Sufficiency of Samples. Fire investigators should be familiar with capabilities and limitations of the scientific laboratory equipment. Not understanding these limitations can result in the fire investigator collecting a quantity of physical evidence that is too small to examine or test.

17.10.3.1 Certainly, the fire investigator will not always have the opportunity to determine the quantity of physical evidence he or she can collect. Often, the fire investigator can collect only that quantity that is discovered during his or her investigation.

17.10.3.2 Each laboratory examination or test requires a certain minimum quantity of physical evidence to facilitate proper and accurate results. The fire investigator should be familiar with these minimum requirements. The laboratory that examines or tests the physical evidence should be consulted concerning these minimum quantities.

17.10.4 Comparative Examination and Testing.

17.10.4.1 During the course of certain fire investigations, the fire investigator may wish to have appliances, electrical equipment, or other products examined to determine their compliance with recognized standards. Such standards are published by the American Society for Testing and Materials, Underwriters Laboratories Inc., and other agencies.

17.10.4.2 Another method of comparative examination and testing involves the use of an exemplar appliance or product. Utilizing an exemplar allows the testing of an undamaged example of a particular appliance or product to determine whether it was capable of causing the fire. The sample should be the same make and model as the product involved in the fire.

17.11 Evidence Disposition.

17.11.1 The fire investigator is often faced with disposing of evidence after an investigation has been completed. The investigator should not destroy or discard evidence unless proper authorization is received. Circumstances may require that evidence be retained for many years and ultimately may be returned to the owner.

17.11.2 Criminal cases such as arson require that the evidence be kept until the case is adjudicated. During the trial, evidence submitted — such as reports, photographs, diagrams, and items of physical evidence — will become part of the court record and will be kept by the courts. Volatile or large physical items may be returned to the investigator by the court. There may be other evidence still in the investigator's possession that was not used in the trial. Once all appeals have been exhausted, the investigator may petition the court to either destroy or distribute all of the evidence accordingly. A written record of authorization to dispose of the evidence should be kept. The criminal investigator should be mindful of potential civil cases resulting from this incident, which may require retention of the evidence beyond the criminal proceedings.

Chapter 18 Origin Determination

18.1 Introduction. This chapter recommends a methodology to follow in determining the origin of a fire. The *area of origin* is defined as a structure, part of a structure, or general geographic location within a fire scene, in which the "point of origin" of a fire or explosion is reasonably believed to be located. The *point of origin* is defined as the exact physical location within the area of origin where a heat source and the fuel interact, resulting in a fire or explosion. The origin of a fire is one of the most important hypotheses that an investigator develops and tests during the investigation. Generally, if the origin cannot be determined, the cause cannot be determined, and generally, if the correct origin is not identified, the subsequent cause determination will also be incorrect. The purpose of determining the origin of the fire is to identify in three dimensions the locations at which the fire began.

18.1.1 This chapter deals primarily with the determination of origin involving structures; however, the methodology generally applies to all origin determinations. Separate chapters address the particular requirements for determining origin in nonstructure fire incidents (motor vehicles, boats, wildfire, etc.).

18.1.2 Determination of the origin of the fire involves the coordination of information derived from one or more of the following:

(1) *Witness Information and/or Electronic Data.* The analysis of observations reported by persons who witnessed the fire or were aware of conditions present at the time of the fire as well as the analysis of electronic data such as security camera footage, alarm system activation, or other such data recorded in and around the time of the fire event
(2) *Fire Patterns.* The analysis of effects and patterns left by the fire *(see Chapter 6)*

(3) *Arc Mapping.* The analysis of the locations where electrical arcing has caused damage and the documentation of the involved electrical circuits *(see Section 9.10)*

(4) *Fire Dynamics.* The analysis of the fire dynamics [i.e., the physics and chemistry of fire initiation and growth *(see Chapter 5)* and the interaction between the fire and the building's systems *(see Chapter 7)*]

18.2 Overall Methodology. The overall methodology for determining the origin of the fire is the scientific method as described in Chapter 4. This methodology includes recognizing and defining the problem to be solved, collecting data, analyzing the data, developing a hypothesis or hypotheses, and most importantly, testing the hypothesis or hypotheses. In order to use the scientific method, the investigator must develop at least one hypothesis based on the data available at the time. These hypotheses should be considered "working hypotheses," which upon testing may be discarded, revised, or expanded in detail as new data is collected during the investigation and new analyses are applied. This process is repeated as new information becomes available. *(See Figure 18.2.)*

18.2.1 Testing any origin hypothesis requires an understanding of the associated fire events as well as the growth of the fire and how the fire spread through the structure. A narrow focus on only identifying the first item ignited and a competent ignition source fails to take into account important data that can be used to test any origin hypothesis. In such a narrow focus, the growth and spread of the fire and the resulting fire damage are not well considered.

18.2.1.1 The purpose of the fire spread analysis is to determine whether the resulting physical damage and available data are consistent with the area of origin hypothesis. For example, a fire starting in a wastebasket is a plausible working hypothesis, but the resulting fire damage would be highly dependent on the position of the initial fuel and any subsequently ignited fuels. If the wastebasket had been located in an area with no adjacent fuel, then the results may be significantly different than if the wastebasket had been located next to a polyurethane sofa. Both hypotheses posit the same first item ignited, but the outcome is very different. Thus, if the origin hypothesis is not consistent with the resulting growth and spread of the fire, it is not a valid hypothesis. Fire spread scenarios within a compartment or building should be analyzed using the principles of fire dynamics presented in Chapter 5 and fire pattern development in Chapter 6.

18.2.1.2 In some instances, a single item, such as an irrefutable article of physical evidence or a credible eyewitness to the ignition, or a video recording, may be the basis for a determination of origin. In most cases, however, no single item is sufficient in itself. The investigator should use all available resources to develop origin and spread hypotheses and to determine which hypotheses fit all of the evidence available. When an apparently plausible hypothesis fails to fit some item of evidence, the investigator should try to reconcile the two and determine whether the hypothesis or the evidence is erroneous.

18.2.1.3 In some cases, it will be impossible to fix the point of origin of a fire. Where a single point cannot be identified, it can still be valuable for many purposes to identify the area(s) of origin. In such instances, the investigator should be able to provide plausible explanations for the area of origin with the supporting evidence for each option. Not identifying a point of origin will not necessarily preclude determining an origin and cause. In some situations, the extent of the damage may reduce the ability to specifically identify the point of origin, without removing the ability to put forward credible origin and cause hypotheses.

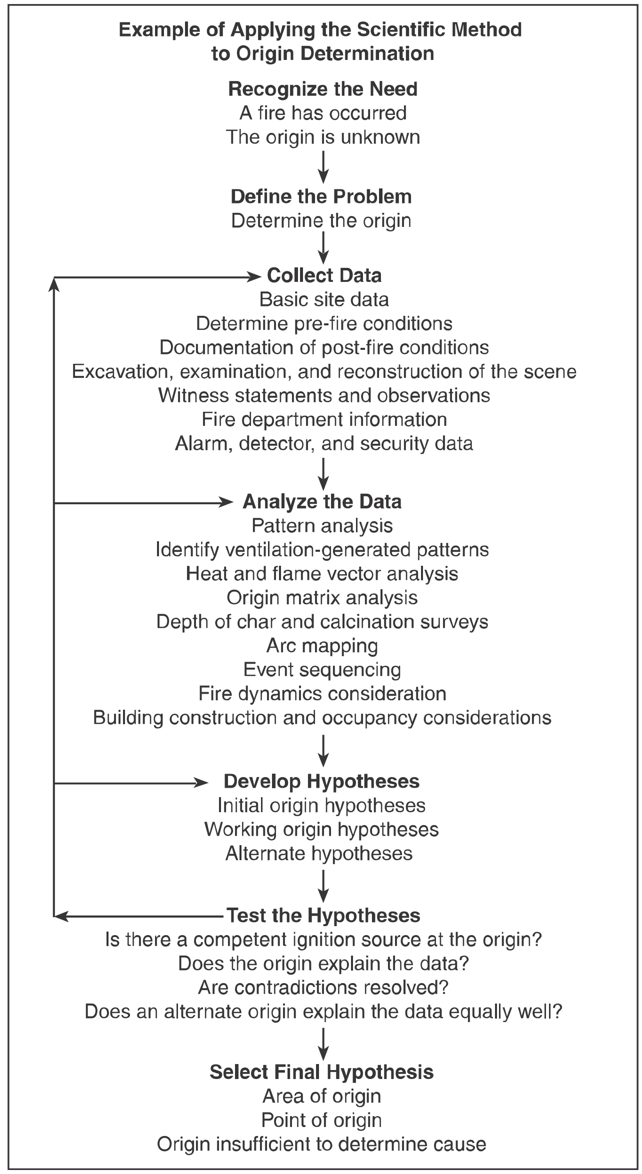

FIGURE 18.2 **An Example of Applying the Scientific Method to Origin Determination.**

18.2.2 Sequence of Activities. The various activities required to determine the origin using the scientific method (data collection, analysis, hypothesis development, and hypothesis testing) occur continuously. Likewise, recording the scene, note taking, photography, evidence identification, witness interviews, cause investigation, failure analysis, and other data collection activities may be performed simultaneously with these efforts. Generally, the various activities of origin determination will follow a routine sequence, while the specific actions within each activity may be taking place at the same time.